PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 4 : H05B 6/64

A1

(11) International Publication Number: WO 88/ 05249

(43) International Publication Date: 14 July 1988 (14.07.88)

(21) International Application Number: PCT/GB87/00916

(22) International Filing Date: 22 December 1987 (22.12.87)

(31) Priority Application Numbers: 8630889, 8717842

(32) Priority Dates: 24 December 1986 (24.12.86), 28 July 1987 (28.07.87)

(33) Priority Country: GB

(71) Applicant *(for all designated States except US)*: MARDON SON & HALL LIMITED [GB/GB]; Tower Road North, Warmley, Bristol BS15 2XL (GB).

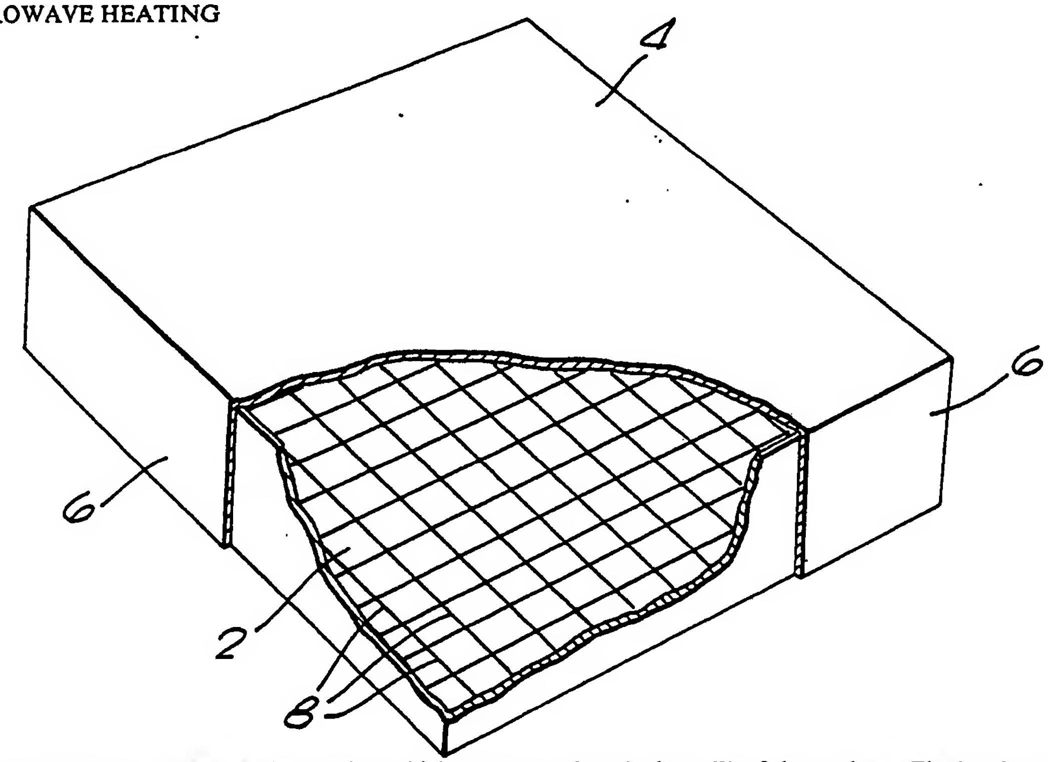
(72) Inventor; and
(75) Inventor/Applicant *(for US only)* : FOWLER, Philip, John [GB/GB]; 1 Fuller Avenue, Corsham, Wiltshire SN13 9NF (GB).

(74) Agent: CHEYNE, John, Robert, Alexander, Mackenzie; Haseltine Lake & Co., 28 Southampton Buildings, Chancery Lane, London WC2A 1AT (GB).

(81) Designated States: AT (European patent), AU, BE (European patent), BR, CH (European patent), DE (European patent), FI, FR (European patent), GB, GB (European patent), IT (European patent), JP, LU (European patent), NL (European patent), SE (European patent), US.

Published
With international search report.
Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: MICROWAVE HEATING



(57) Abstract

Packages for foodstuffs include a heating device, which may comprises the base (2) of the package. The heating device comprises a pattern made up of elongate elements (8) of an electrically conductive material, such as aluminium. The pattern is applied to the substrate by a hot foil stamping process. Alternative configurations for the pattern are possible, for example the elongate elements (8) may be arranged in a radial manner. The elongate elements (8) are heated in the presence of microwaves, to assist crisping or browning of foodstuffs in the package when cooked in a microwave oven.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	FR	France	ML	Mali
AU	Australia	GA	Gabon	MR	Mauritania
BB	Barbados	GB	United Kingdom	MW	Malawi
BE	Belgium	HU	Hungary	NL	Netherlands
BG	Bulgaria	IT	Italy	NO	Norway
BJ	Benin	JP	Japan	RO	Romania
BR	Brazil	KP	Democratic People's Republic of Korea	SD	Sudan
CF	Central African Republic	KR	Republic of Korea	SE	Sweden
CG	Congo	LI	Liechtenstein	SN	Senegal
CH	Switzerland	LK	Sri Lanka	SU	Soviet Union
CM	Cameroon	LU	Luxembourg	TD	Chad
DE	Germany, Federal Republic of	MC	Monaco	TG	Togo
DK	Denmark	MG	Madagascar	US	United States of America
FI	Finland				

MICROWAVE HEATING

TECHNICAL FIELD

This invention relates to the packaging of products (normally food) intended to be heated by microwave radiation.

BACKGROUND ART

The number of households with a microwave oven is increasing, and there is a correspondingly expanding market for prepared food products, including ready-made meals, which can be reheated and cooked in domestic microwave ovens. Consequently, there is a need for packages suitable not only for displaying these products in retail outlets, but also for holding the products while they are being cooked in a microwave oven, thus avoiding any need to transfer the food from the package in which it is sold to a different container for cooking. Since food packages for retail sale are generally disposable, they must be relatively inexpensive, even if the product is to be kept in them while cooking.

One disadvantage of microwave cooking is that, unless special measures are taken, it is not possible to brown or crisp the product. For example, where a product includes pastry, the pastry is usually soggy and unappealing by comparison with a similar product cooked in a conventional oven. One reason for this is that the heating of a product in a microwave oven is achieved principally as a result of water within the product. Liquid water absorbs microwaves and heats up, and the heat thus generated spreads by conduction throughout the product. However, steam is much more transparent to microwaves than liquid water, and consequently, when steam is formed, the steam is not heated further by the microwave energy. The result of this is that the temperature of the product, while still moist, cannot rise above approximately 100° C,

and this temperature is too low to cause crisping or browning.

Attempts have been made to avoid this problem in packages intended for microwave cooking. One proposal is to use a so-called "browning pad", which consists of, for example, a sheet of cartonboard to which is laminated a layer of metallized plastics film. Usually, this film includes metal particles (such as aluminium) which have been applied to the film by vapour deposition techniques. The metallization thus extends continuously over the whole of one surface of the browning pad. Another proposal is disclosed in European Patent Specification No. 0161739, in which the lid of a package is provided with an interrupted metallic coating in the form of separate islands. The purpose of the islands is to reflect microwaves within the container in order to improve the heating efficiency. Microwaves enter the container through regions where no islands are present, or between adjacent islands. The islands themselves are not heated by the microwaves since the metallic coating is of substantial thickness and consequently has low resistance.

US Patent No. 4230924 discloses the wrapping of a food product in a material which also has separated islands of metallization. The metallic coatings are very thin, and are stated to absorb some microwave energy which is converted into heat. Also, it is stated that electric currents are transmitted through the substrate between adjacent islands, so resistively heating the substrate. Whatever the heating mechanism, it is clear that the gaps between adjacent islands should be very small and carefully controlled. The islands are formed by means of a suitable screen or mask.

A problem with the packaging material disclosed in

US Patent No. 4230924 is that it would be very difficult to control the thickness of the metallic coating sufficiently accurately to provide the required degree of heating, and also that it would be difficult and inconvenient, using masking techniques, to obtain a desired pattern on the packaging material in order to provide, for example, differential heating of different parts of a product.

DISCLOSURE OF INVENTION

According to the present invention there is provided a method of manufacturing a heating device for use in a microwave oven, the method comprising applying an electrically conductive material to a dielectric substrate by a hot foil stamping process, the thinness and the nature of the material being such that the material is heated when subjected to microwave energy.

The present invention also provides a heating device manufactured by the method defined above.

In a preferred method in accordance with the present invention the hot foil stamping process utilizes a thin film of heat resistant plastics material, such as polyethylene terephthalate (available, for example, under the names "Melinex"[1], "Mylar"[2] and "Hostaphan"[3]). The film may be coated with a lacquer which will release from the film during the hot stamping process to provide a lacquer coating on the material transferred to the substrate. The lacquer is provided with a thin deposit of the electrically conductive material. This deposition may be achieved, for example, by vapour deposition under high vacuum. A thermally activable adhesive layer is then applied to the deposit. This adhesive layer is

"Melinex"[1] Registered Trade Mark of ICI

"Mylar"[2] Registered Trade Mark of DuPont

"Hostaphan"[3] Registered Trade Mark of Hoechst

formulated so as to bond to the substrate, which may, for example, be a paper based material, that is to say, it may be plain cellulose, or cellulose provided with a polymeric coating. In the hot foil stamping process, the film is placed on the substrate and a heated stamp, having the desired pattern, is brought into contact with the film to transfer the adhesive, the deposit and the lacquer to the substrate in that pattern. The lacquer provides a barrier between the deposit and any food product which with the coated substrate will come into contact. To provide additional protection, a further coating of acrylic emulsion or other suitable material may be applied over the coated substrate.

To achieve satisfactory results, the optical density of the coating forming the conductive elements is significantly less than the optical density (approximately 2.5 or more) of coatings hitherto applied by hot foil stamping techniques for decorative effects. For example, the optical density may be between 0.2 and 1.0.

The electrically conductive material may be applied to the substrate as a discontinuous pattern. The use of the hot stamping process provides considerable freedom in the design of this pattern. The pattern may comprises a plurality of elongate elements, which may be straight, but this is not essential. For example, the elongate elements may be in the form of closed loops disposed in a concentric array. The elongate elements may intersect one another, and may thus be disposed in the form of a grid. Alternatively, the elongate elements may radiate from a common central region. Furthermore, their edges may radiate from the same common central region, so that the elongate elements are generally sector shaped.

The electrically conductive material may, for example, comprise an elemental metal such as aluminium,

alloys such as stainless steel and nickel-chrome, or conductive carbon such as graphite. Furthermore, the term "conductive" as used herein includes materials which are semiconductive, and thus the material may, for example, comprise indium tin oxide, aluminium oxide, iron oxide or other ferromagnetic or ferrimagnetic materials. The deposit should be sufficiently thin to provide a significant electrical resistance in the elongate elements, for example a resistance in the region of 40 to 200 ohms per square is appropriate for aluminium. To achieve such resistances, the thickness of the deposit must be controlled accordingly, and need not be the same for different materials. The thicknesses envisaged in the context of the present invention are too small to be measured accurately by conventional techniques. Instead, the thickness is represented by the optical density of the coating. The conductive elements, if made of metal such as aluminium may, for example, have a thickness providing an optical density in the range 0.2 to 1.0.

The heating device may comprise a component separate from the main body of a package in which the product is contained. For example, it may comprise a flat sheet. Alternatively, the heating device may comprise all or part of some of more of the walls of the package. For example, it may comprise the base of the package and/or the top wall of the package. Where the material of the wall of the package comprises the substrate, the electrically conductive material may be provided either on the inside or on the outside of the package. The electrically conductive material may be used to provide a decorative effect, particularly if it is provided on the outside of the package.

The proportion of the area of the substrate which is covered by the electrically conductive material,

relative to the area left clear, need not be the same over the entire surface of the heating device. Thus, for example, one region of the heating device may have relatively closely spaced elongate elements, for example with a ratio of the area of the material to the area of uncoated substrate in the range 15:1 to 5:1, while another region may have relatively widely spaced elongate elements, for example, with the correspnding ratio in the range 2:1 to 0.5:1. This will provide a differential heating effect within the package so that the degree of browning or crisping of the product can be controlled. This can be particularly useful, for example, if the package contains a dish made up of several portions, for example, a meat portion and a vegetable portion. Also, it can provide benefits where the package contains a relatively large product, for example a pizza, where it has been found that even heating of a heating device on which the product is supported can be achieved by decreasing the spacing between adjacent conductive elements towards the centre of the heating device. The different regions can be either disposed side-by-side or one within the other.

BRIEF DESCRIPTION OF DRAWINGS

Figure 1 is a partially cut away view of a package;

Figure 2 corresponds to Figure 1 but shows an alternative package;

Figure 3 shows a third package;

Figures 4 to 7 show four alternative designs for heating devices for use with the packages of Figures 1 to 3;

Figure 8 is a perspective view of a two-compartment package;

Figure 9 is a sectional view through the filled package of Figure 8; and

Figure 10 shows a further embodiment of a package.

MODES FOR CARRYING OUT THE INVENTION

The package shown in Figure 1 comprises a base 2, a top 4 and side walls 6. The package comprises a carton made from cartonboard, and is intended to contain a food product both for retail sale and for cooking in a microwave oven. That is to say, the product is placed in a microwave oven for cooking without being removed from the package in which it is sold. In some circumstances, however, it may be desirable for the package to be opened before placing in a microwave oven.

The internal surface of the base 2 is provided with elongate conductive elements 8 which are arranged in a grid-like pattern covering substantially the entire surface of the base. The elements 8 are applied to the base 2 by hot foil stamping. The elements themselves comprise aluminium.

Figure 2 shows a similar carton, although conductive elements 8 are provided not only on the internal surface of the base 2, but also on the external surface of the top wall 4.

Figure 3 shows an alternative embodiment, in which the conductive elements 8 are provided on the internal surface of both the base 2 and the top wall 4.

When a carton in accordance with any one of Figures 1 to 3 is placed in a microwave oven, microwaves are directed at the carton from the top and from all sides. If the carton is raised from the base of the oven, microwaves will also be reflected off the base of the oven towards the base of the carton. Cartonboard is a dielectric, i.e., it is not electrically conductive, and is consequently transparent to microwaves. As a result, microwaves will enter the carton of Figure 1 through the top wall 4 and the side walls 6. However, the network of conductive elements 8 provide a complete or partial

screen to the microwaves (depending on their thickness and relative spacing), and so prevents microwaves from entering the container through the base 2, or else attenuates any microwaves which do pass through the base 2. Furthermore, microwaves impinging on the base 2 from within the package are partially or completely reflected back into the package by the conductive elements 8, so providing an additional heating effect on the product within the package.

Additionally, however, the conductive elements 8 are heated by the microwaves. The degree of heating depends on how much of the incident microwave energy is absorbed by the conductive elements 8, but satisfactory results have been achieved where the temperature of the heating device rises to approximately 160° C. It is believed that the heating effect arises from the generation of potential differences across the network of conductive elements 8, causing current to flow within the elements 8 so heating them resistively.

The heating of the conductive element 8 creates several effects. Firstly, the adjacent portions of the product within the package are heated by the heating device to a higher temperature than is achieved by the direct action of the microwaves on the product. The presence of water in the product limits this direct heating to a temperature of approximately 100°C, which is too low to provide satisfactory browning or crisping, for example of pastry-based products. The additional heating effect arising from the conductive elements 8, either by conduction (if the product is in direct contact with the elements 8), by radiation or by convection can raise the temperature of the outer portions of the product sufficiently high to cause browning or crisping. Secondly, the heating effect of the elements 8 can drive off moisture from the outer regions of the product, so drying them. A dry product

will not be subject to the temperature limit of 100°C, and so will be heated more rapidly by the direct action of the microwaves (assuming that the outer region of the product contains a microwave absorber, such as a suitable cooking oil or fat). Thus, browning or crisping of the outer regions may be achieved directly by the effect of the microwaves, but only after the moisture in that portion has been driven off by the heating effect of the conductive elements 8. A third effect is that the heat generated in the conductive elements 8 will cause air circulation within the package as a result of convection, and this will assist in the evaporation of moisture from the outer regions of the product. Thus, crisping of the outer surface can take place even in portions of the product which are not directly adjacent the conductive elements 8.

Although the effects noted above have been described with reference to crisping or browning, they can also assist in the defrosting of frozen products in microwave ovens.

An important feature of the present invention is that the conductive elements are applied by using a hot foil stamping process. The use of this process provides opportunities for laying the conductive elements in a pattern which is appropriate for the particular product to be contained in the package. Figures 4 to 7 represent different configurations which can be achieved. These configurations are shown by way of example only, to represent the wide variety of possible patterns which can be produced.

Figure 4 shows a network of conductive elements 8, in which the elements 8 form a square grid. The thickness of each element 8 is approximately 1 mm, and the spacing between adjacent elements 8 is approximately 3.25 mm. The ratio of the areas of the conductive elements and the free spaces is thus

approximately 1:1, but more precisely 0.96:1.

Figure 5 shows conductive elements 8 arranged in a pattern in the form of concentric oblong loops, the outer ones of which are interrupted. It will be appreciated that the spacing between adjacent loops increases in the direction away from the centre. Also, the outer elements 8 are slightly wider than the inner ones. Thus, the width of the inner loops is approximately 1.5 mm, while the width of the outermost interrupted loops is approximately 2.5 mm. The mutual spacing of the innermost loops is less than 1 mm, while the spacing of the outermost continuous loops is approximately 3 mm, with the interrupted loops at the very outside even further apart.

With a heating device in the form shown in Figure 5, a greater heating effect can be experienced at the centre than at the outside. Thus, for example, a pastry-based product resting on the heating device will be heated more intensely at the centre, and this will counteract the natural tendency of the product to overcook more readily at the outside.

A similar effect is achieved with the pattern shown in Figure 6, where the conductive elements radiate from the centre. The inner region of the pattern is circular, and comprises relatively large, sector-shaped, elements 8A which are separated from each other by parallel sided spaces. The outer region has elements 8B which are defined between lines which extend generally radially from the centre, and which are less densely packed than the elements 8A. Such a heating device may be suitable for products such as pizza, which may have a considerable overall dimension, for example a diameter greater than 200 mm. It has been found that browning pads having a uniform pattern, or a continuous metallized surface, show a tendency to reach greater temperatures at the outside than at the

inside, particularly when the browning pads have a linear dimension larger than approximately 125 mm. The pattern shown in Figure 6 should reduce this tendency, so that charring of the outside edges of the product can be avoided.

Figure 7 shows a heating device suitable for use in a package containing a complete meal consisting of more than one portion. The conductive elements 8C and 8D are laid out in two groups, corresponding to regions of the heating device which will be occupied by, or adjacent to, different portions of the product. Thus, for example, a meat portion may be provided on the region occupied by the conductive elements 8D, while vegetables may be provided in the region occupied by the conductive elements 8C. The conductive elements 8D are narrower than the conductive elements 8C, and cover a greater area of the heating device. Consequently, the conductive elements 8D will reach a greater temperature than the conductive elements 8C. This will enable the meat portion to be properly cooked and, where appropriate, browned, while the vegetables on the conductive elements 8C will be cooked at a more appropriate lower temperature.

Figures 8 and 9 show a carton which is divided into two compartments 10 and 12. The compartment 10 contains potato chips 14 and the compartment 12 contains steak 16. The base of the compartment 10 is provided with a heating device 15 having a hot stamped pattern of conductive elements 8, while no such pattern is provided in the compartment 12. The conductive elements 8 are arranged in a radial array, similar to the inner region of the pattern shown in Figure 6.

The lid 17 of the carton is perforated in a manner which enables the compartment 10 to be opened while the compartment 12 remains closed. The use of this carton is discussed more fully below with reference to Example

III.

Figure 10 shows a carton of which the base is provided with a conductive coating 19. This coating is interrupted at regions 18 which are shaped either to provide a decorative appearance or to represent an appropriate logo or name. For example, the uncoated areas may represent the name of the manufacturer of the product packaged in the carton.

Specific details of the conductive elements and the use of packages incorporating them will now be described by reference to the following Examples.

EXAMPLE I

A heating device was made from 500 micron carton board coated within 45 micron extruded polyester, to which was applied a pattern as illustrated in Figure 6. The inner circular region was 65 mm in diameter and the ratio of metallized area to plain area was approximately 10:1. The ratio of metallized area to plain area in the outer region was approximately 1:1. The optical density of the stamping foil used was 0.65. A standard 5-inch (125 mm) pizza was microwaved on this heating device for 3 minutes. The central region of the heating device reached a temperature of 200-240°C, while the periphery of the pizza reached a temperature of 160-200°C. After cooking, the crisping of the dough base of the pizza was found to be surprisingly even.

EXAMPLE II

An existing ready-meal carton (McCain[4] Farmsteak & Chips) was modified by providing a metal coated heating device 15 in the manner shown in Figure 8. Thus, the heating device was situated under the chips only, and had an area of 75 x 130 mm using 0.65 optical density stamping foil. The radial pattern had a ratio of metallized area to plain area of approximately 10:1.

[4] Trade Mark of McCain Foods Limited

The carton and its contents were placed in a microwave oven with the lid 17 above the chips opened. Thus, during cooking, the chips were directly heated by the microwaves and by the heating effect of the heating device, and were indirectly heated as a result of convection currents in the carton. The package was cooked at 650 watts for 4 minutes, followed by a 1 minute hold in the oven. The contents were then shaken and allowed to stand for a further minute. The chips were found to be noticeably crisp and more palatable than is normally expected from microwave cooking. The temperature achieved in the heating device was 180-190°C.

EXAMPLE III

The carton shown in Figure 10 was coated on its base with 0.8 optical density film, leaving plain areas in the form of the trading logo of the product manufacturer. The ratio of metallized area to plain area was approximately 6:1. Apart from the metallized coating, the carton was one conventionally used for microwaving chips, and had dimensions of 80mm x 150mm x 40mm. A 100 gram portion of potato chips was cooked in a microwave oven for 3 minutes at 650 watts with the lid open, followed by a 1 minute hold. The package was then shaken and allowed to stand for a further minute. The chips had improved crispness. The temperature of the base during cooking reached 180-200°C.

It will be appreciated that the precise layout of the conductive elements 8 will be selected to provide the best results with the particular product with which they are to be used. The essential feature is that the conductive elements are elongate, but their thickness, shape and mutual spacing can be adjusted to provide a desired heating effect which may not be consistent across the full area of the heating device. The use of a hot foil stamping process to apply the conductive

elements enables the layout of the conductive elements to be selected as appropriate. Furthermore, the heating device can be part of the package itself, as shown in Figures 1 to 3, or it could be a separate element inserted into the package. Although Figures 1 to 3 show the conductive elements 8 applied to the lid and base of the carton, they could also be applied to other parts of the carton, for example the side walls.

Cartons embodying the present invention may, for example, have a length of 50 to 300mm, a width of 65 to 300mm and a depth of 20 to 150mm.

CLAIMS

1. A method of manufacturing a heating device for use in a microwave oven, the method comprising applying an electrically conductive material to a dielectric substrate, the thinness and the nature of the material being such that the material is heated when subjected to microwave energy, characterized in that the electrically conductive material is applied to the substrate by a hot foil stamping process.

2. A method as claimed in claim 1, characterized in that the material is applied to the substrate by transfer from a plastics foil, the optical density of the plastics foil carrying the material being not less than 0.2 and not greater than 1.0.

3. A method as claimed in claim 2, characterized in that a layer of lacquer is provided between the material and the plastics foil, which lacquer is transferred to the dielectric substrate during the hot stamping process to provide a lacquer coating on the material.

4. A method as claimed in claim 1, characterized in that the electrically conductive material is applied to the dielectric substrate as a discontinuous layer.

5. A method as claimed in claim 4, characterized in that the electrically conductive material is applied to the dielectric substrate in a pattern comprising a plurality of elongate elements.

6. A method as claimed in claim 5, characterized in that the elongate elements intersect one another.

7. A method as claimed in claim 6, characterized in that the elongate elements are disposed in the form of a grid.

8. A method as claimed in claim 5, characterized in that the elongate elements, or at least some of them, radiate from a common central region.

9. A method as claimed in claim 4, characterized

in that the surface pattern is such that a first region of the heating device has a relatively high ratio of electrically conductive material to uncoated substrate and a second region of the heating device has a relatively low ratio of electrically conductive material to uncoated substrate.

10. A method as claimed in claim 9, characterized in a first region and the second region are disposed side-by-side on the heating device.

11. A method as claimed in claim 10, characterized in that the second region surrounds the first region.

12. A heating device for use in a microwave oven, the heating device comprising a dielectric substrate provided with a surface pattern of an electrically conductive material, the thinness and the nature of the material being such that it is heated when subjected to microwave energy, characterized in that the surface pattern comprises elongate elements.

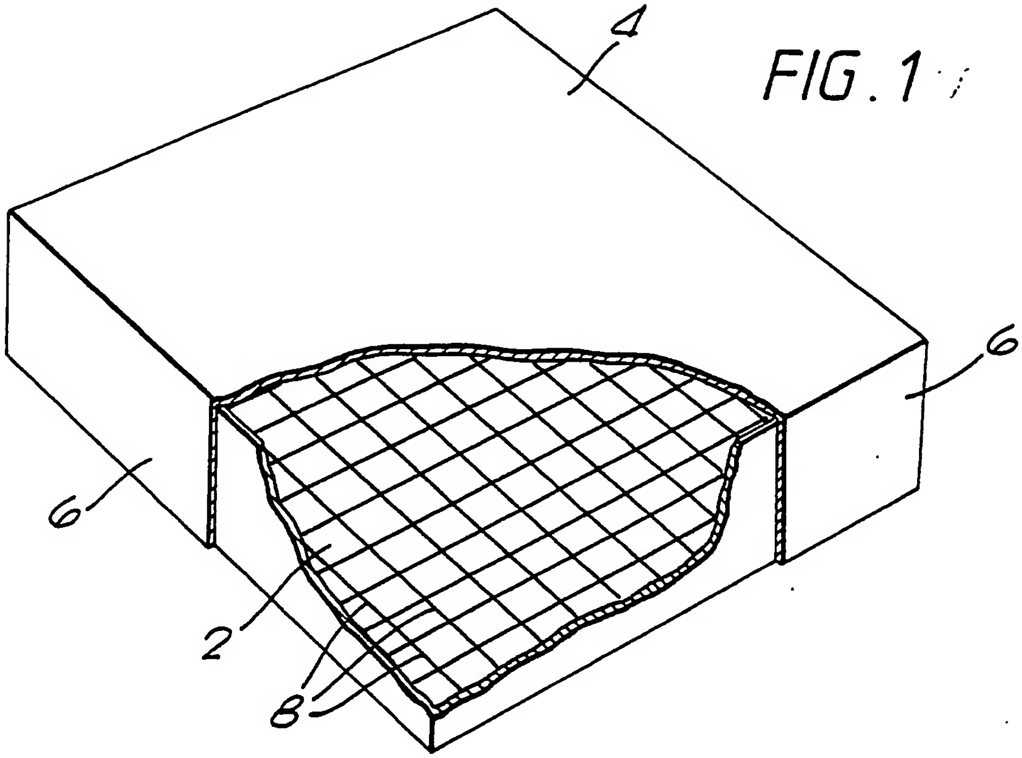


FIG. 1

FIG. 2

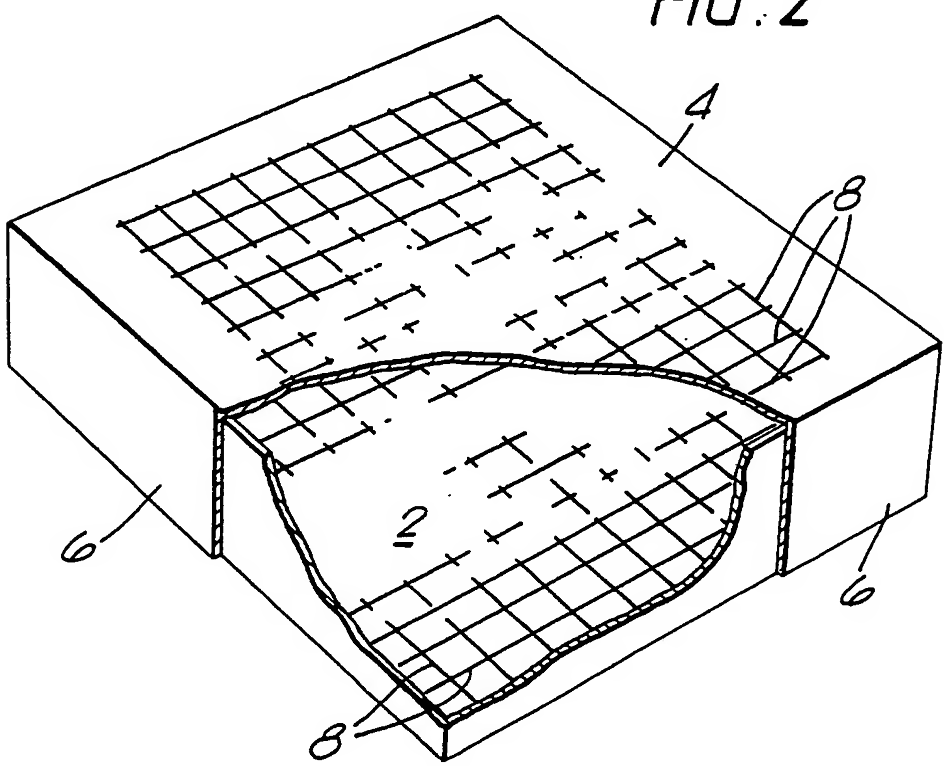
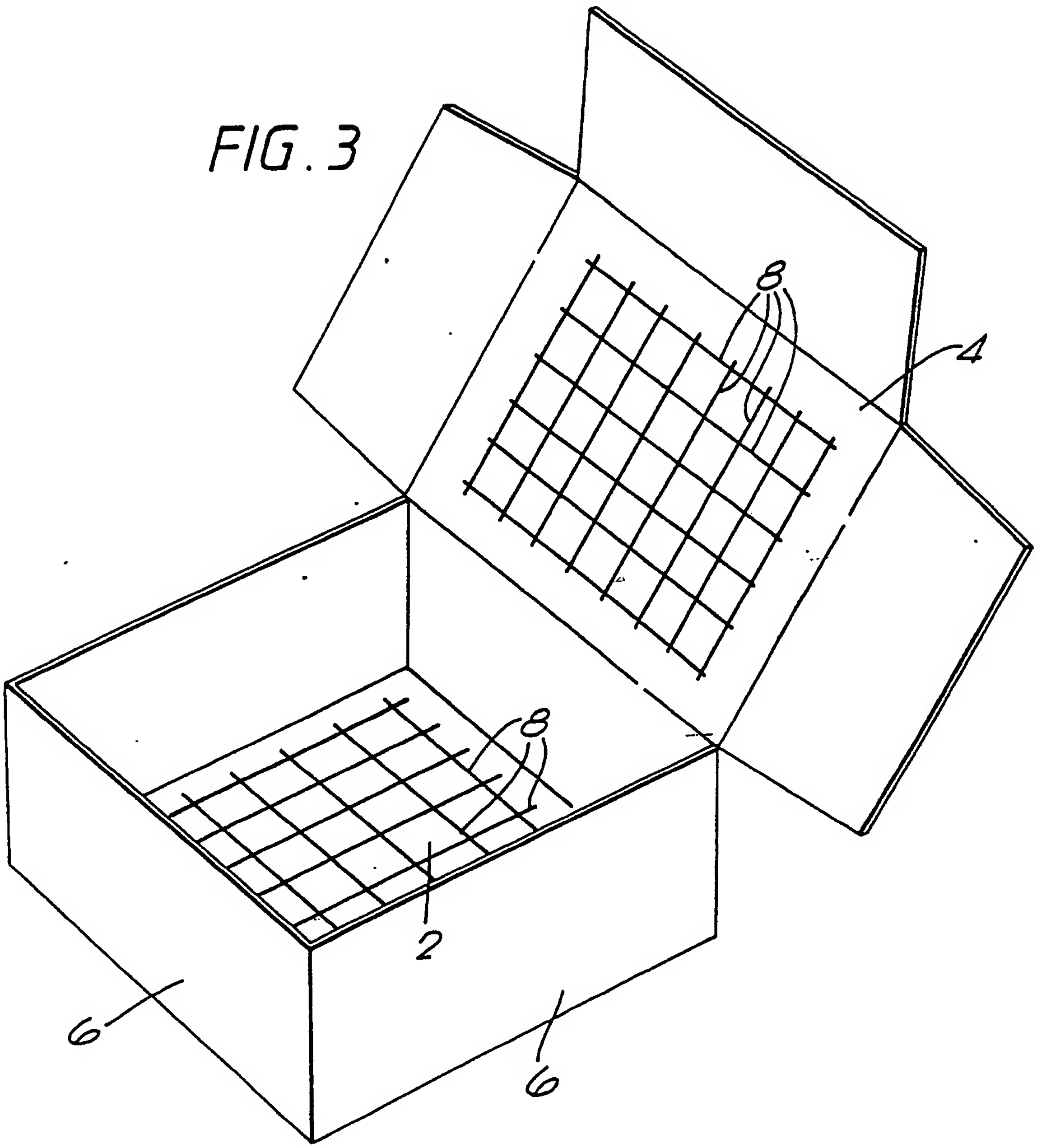


FIG. 3



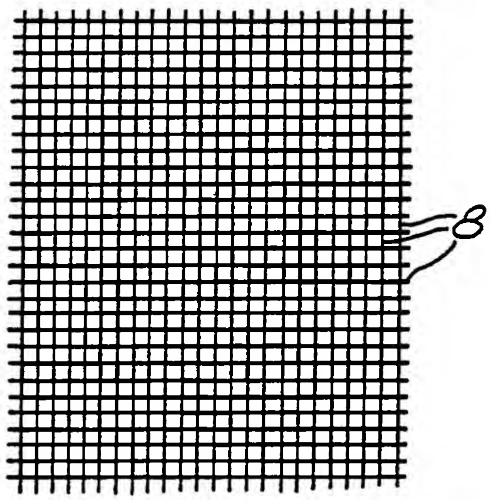
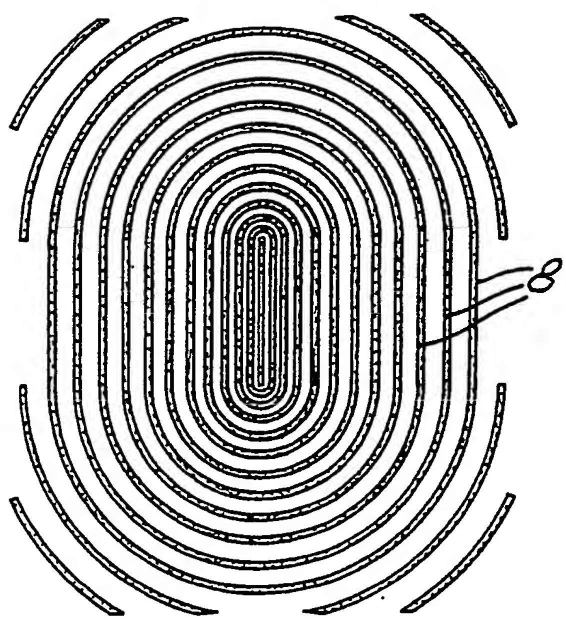


FIG. 4

FIG. 5



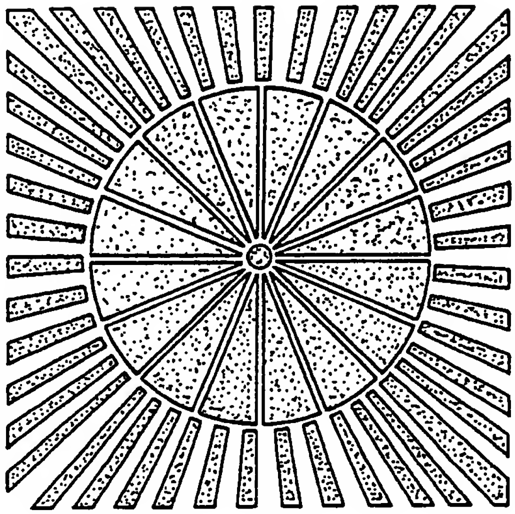
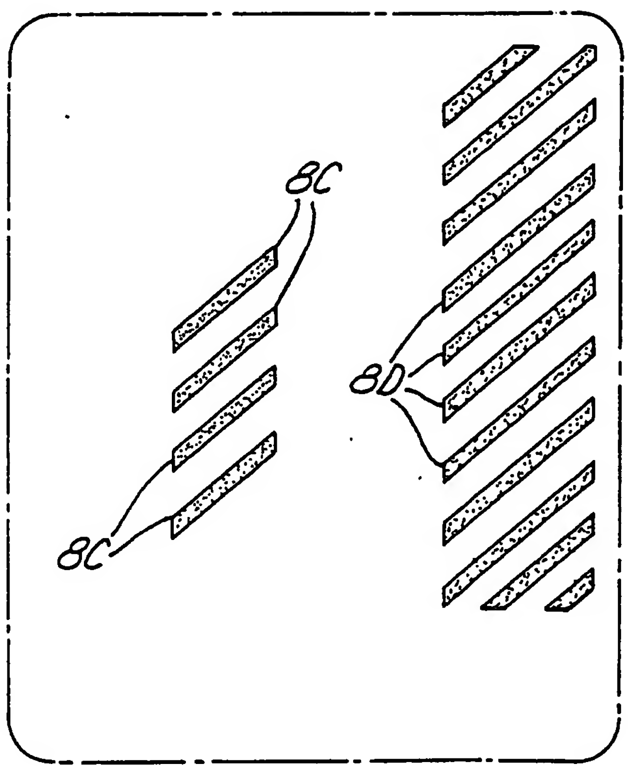


FIG. 6

FIG. 7



SUBSTITUTE SHEET

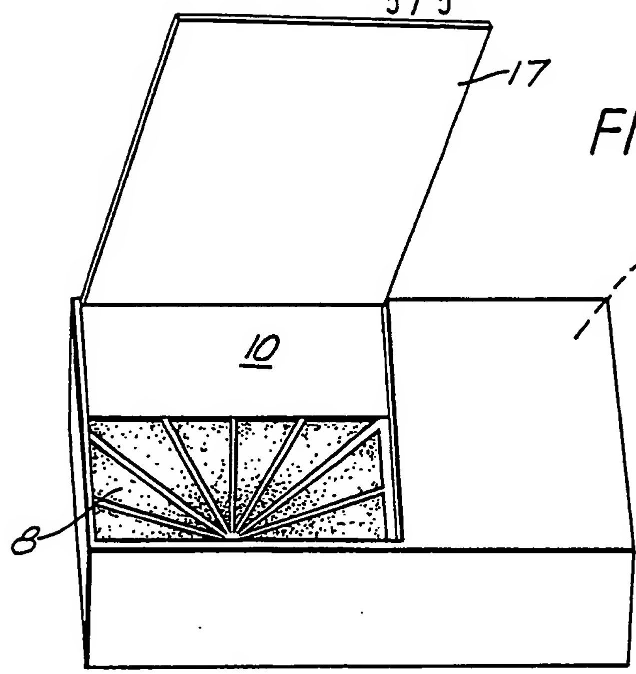


FIG. 8

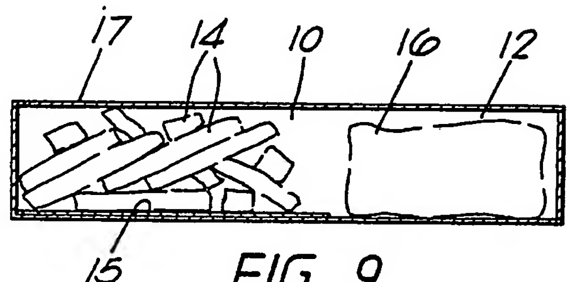


FIG. 9

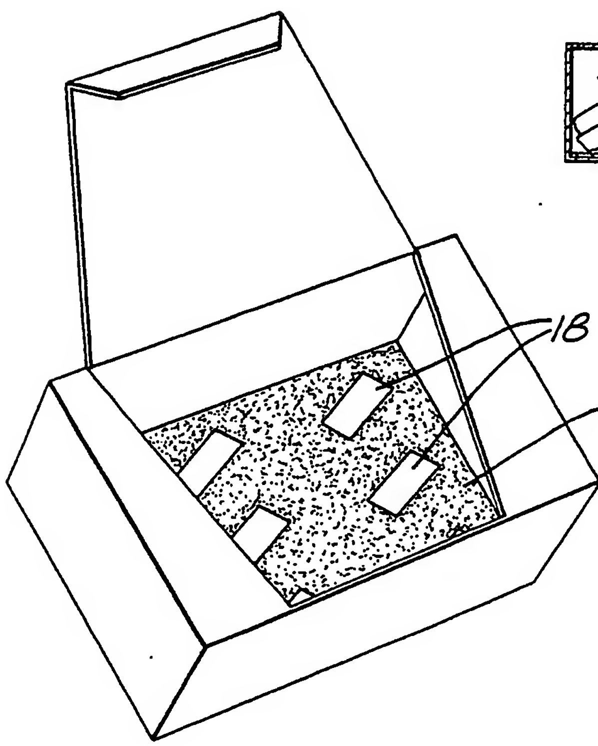


FIG. 10

INTERNATIONAL SEARCH REPORT

International Application No PCT/GB 87/00916

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC^4: H 05 B 6/64

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC^4	H 05 B 6/00; B 65 D 81/00; A 47 J 36/00

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category [*]	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
A	US, A, 3302632 (FICHTNER) 7 February 1967, see column 2, lines 12-38; figure 1 --	1,4-7,9, 10,12
A	US, A, 3219460 (BROWN) 23 November 1965, see column 2, lines 24-61; figures 1-4 --	1,4,5,9, 10,12
A	EP, A, 0140282 (SHOWA DENKO) 8 May 1985, see page 4, last paragraph; page 10, paragraph 2 --	1,2
A	EP, A, 0205304 (BECKETT) 17 December 1986, see page 1, lines 5-11; page 2, lines 16-31; page 4, lines 20-24; figures 2,3 --	1,4
A	US, A, 4267224 (KANZELBERGER) 12 May 1981, see column 3, lines 40-57; column 7, lines 47-53 --	1-3
P,X	US, A, 4676857 (SCHARR et al.) 30 June 1987, see column 4, lines 17-61; column 6, lines 3-14; figures 2,6,7 --	1-4,8,9,12

* Special categories of cited documents: [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
24th March 1988	6 JUN 1988
International Searching Authority	**Signature of Authorized Officer**
EUROPEAN PATENT OFFICE	P.C.G. VAN DER PUTTEN

International Application No. PCT/GB 87/00916

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category *	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No
A	US, A, 4196331 (LEVECKIS et al.) 1 April 1980	
A	EP, A, 0024605 (PRODUITS FINDUS S.A.) 11 March 1981	

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO.

GB 8700916
SA 19903

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
The members are as contained in the European Patent Office EDP file on 20/04/88
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US-A- 3302632		None	
US-A- 3219460		None	
EP-A- 0140282	08-05-85	JP-A- 60090130 US-A- 4616766 JP-A- 60090131	21-05-85 14-10-86 21-05-85
EP-A- 0205304	17-12-86	AU-A- 5837286 JP-A- 62023743	11-12-86 31-01-87
US-A- 4267224	12-05-81	US-A- 4520064	28-05-85
US-A- 4676857	30-06-87	None	
US-A- 4196331	01-04-80	JP-A- 55055961	24-04-80
EP-A- 0024605	11-03-81	JP-A- 56032261 AU-A- 6154780 CA-A- 1117915 US-A- 4351997 SE-A- 7907117 AU-B- 534134	01-04-81 05-03-81 09-02-82 28-09-82 28-02-81 05-01-84

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82